

CLAIMS

1. A process for producing a carboxylic acid comprising

5           allowing an alcohol having "n" carbon atom(s) or a derivative thereof to react with carbon monoxide continuously in the presence of a catalytic system, and purifying the resultant reaction mixture to give a purified carboxylic acid having "n+1" carbon atoms,

10           wherein a higher bp catalyst component is separated from the reaction mixture to give a crude mixture containing at least a carboxylic acid having "n+2" carbon atoms, a carboxylic acid having "n+1" carbon atoms, an ester of the carboxylic acid having "n+1" carbon atoms with the alcohol, and water;

15           the crude mixture is fed to a higher bp component-separation column, and is separated into a bottom fraction and an overhead fraction, the bottom fraction contains at least the carboxylic acid having "n+2" carbon atoms, and the overhead fraction contains at least the carboxylic acid having "n+1" carbon atoms, the ester of the carboxylic acid having "n+1" carbon atoms with the alcohol, and water; and

20           the overhead fraction from the higher bp component-separation column is separated by a carboxylic acid-separating column into a bottom fraction and an overhead fraction, the bottom fraction contains the

carboxylic acid having "n+1" carbon atoms, and the overhead fraction contains at least the ester and water.

2. A process according to claim 1, wherein the reaction mixture contains water in a proportion of not more  
5 than 20% by weight.

3. A process according to claim 1, wherein the crude mixture further contains an aldehyde having "n+1" carbon atoms, and the crude mixture is fed to the higher bp component-separation column.

10 4. A process according to claim 1, wherein the crude mixture containing the carboxylic acid having "n+2" carbon atoms, an aldehyde having "n+1" carbon atoms, the carboxylic acid having "n+1" carbon atoms, the ester of the carboxylic acid having "n+1" carbon atoms with the  
15 alcohol and water is fed to the higher bp component-separation column, and is separated into the bottom fraction and the overhead fraction, the bottom fraction contains the carboxylic acid having "n+2" carbon atoms, and the overhead fraction contains the aldehyde having  
20 "n+1" carbon atoms, the carboxylic acid having "n+1" carbon atoms, the ester of the carboxylic acid having "n+1" carbon atoms with the alcohol, and water;

the overhead fraction from the higher bp component-separation column is separated by the carboxylic  
25 acid-separating column into the bottom fraction and the overhead fraction, the bottom fraction contains the carboxylic acid having "n+1" carbon atoms, and the overhead

fraction contains at least the aldehyde, the ester and water;

the overhead fraction from the carboxylic acid-separating column is separated by an aldehyde-separating column into an overhead fraction and a bottom fraction, the overhead fraction contains the aldehyde, and the bottom fraction contains at least the ester and water; and

the bottom fraction from the aldehyde-separating column is recycled to the reaction system.

5. A process according to claim 4, wherein the catalytic system comprises a catalyst containing a metal element of the Group 8 of the Periodic Table of Elements, an alkali metal halide, and an alkyl halide;

distillation in the carboxylic acid-separating column is carried out in the presence of the ester of the carboxylic acid having "n+1" carbon atoms with the alcohol, the alkyl halide and water for separating the bottom fraction from the overhead fraction, the bottom fraction contains the carboxylic acid having "n+1" carbon atoms, and the overhead fraction contains water, the alkyl halide and the ester;

the overhead fraction from the carboxylic acid-separating column is separated by the aldehyde-separating column into the overhead fraction and the bottom fraction, the overhead fraction contains the aldehyde, and the bottom fraction contains water, the alkyl halide and

the ester; and

the bottom fraction from the aldehyde-separating column is recycled to the reaction system.

6. A process according to claim 1, wherein the  
5 crude mixture in which at least an aldehyde having "n+1" carbon atoms has been removed is fed to the higher bp component-separation column.

7. A process according to claim 1, wherein the  
higher bp catalyst component is separated from the reaction  
10 mixture to give a crude mixture, and the resultant crude mixture is fed to a lower bp component-separation column, and is separated into the overhead fraction and the bottom fraction, the overhead fraction contains at least an aldehyde having "n" carbon atom(s), and the bottom fraction  
15 contains at least the carboxylic acid having "n+2" carbon atoms;

the bottom fraction from the lower bp component-separation column is separated by the higher bp component-separation column into the bottom fraction and  
20 the overhead fraction, the bottom fraction contains the carboxylic acid having "n+2" carbon atoms, and the overhead fraction contains at least the carboxylic acid having "n+1" carbon atoms, the ester of the carboxylic acid having "n+1" carbon atoms with the alcohol, and water; and

25 the overhead fraction from the higher bp component-separation column is separated by the carboxylic acid-separating column into the bottom fraction containing

the carboxylic acid having "n+1" carbon atoms and the overhead fraction containing at least the ester and water.

8. A process according to claim 7, wherein the catalytic system comprises a catalyst containing a metal  
5 element of the Group 8 of the Periodic Table of Elements, an alkali metal halide, and an alkyl halide; and

distillation in the carboxylic acid-separating column is carried out in the presence of the ester, the alkyl halide and water to give the bottom fraction  
10 containing the carboxylic acid having "n+1" carbon atoms, and the overhead fraction containing at least the ester, the alkyl halide and water.

9. A process according to claim 7 or 8, wherein the overhead fraction separated by the carboxylic  
15 acid-separating column is recycled to the reaction system.

10. A process according to claim 7, wherein the overhead fraction separated by the lower bp component-separation column is further fed to an aldehyde-separating column to separate an overhead fraction containing an  
20 aldehyde having "n+1" carbon atoms to give a bottom fraction containing at least the ester and water; and

the bottom fraction is recycled to the reaction system.

11. A process according to any one of claims 1,  
25 4 and 7, wherein distillation in the carboxylic acid-separating column is carried out in the presence of at least the ester and water to give the bottom fraction containing

the carboxylic acid having "n+1" carboxylic acid, and the overhead fraction.

12. A process according to claim 1 which comprises allowing at least one member selected from the group consisting of methanol, methyl acetate and dimethyl ether to react with carbon monoxide continuously in the presence of the catalytic system, and

purifying the resultant reaction mixture to produce a purified acetic acid,

10 wherein the higher bp catalyst component is separated from the reaction mixture to give the crude mixture;

the crude mixture is fed to the higher bp component-separation column, and is separated into the bottom fraction and the overhead fraction, the bottom fraction contains at least propionic acid, and the overhead fraction contains at least acetic acid, methyl acetate and water; and

the overhead fraction from the higher bp component-separation column is separated by the carboxylic acid-separating column into the bottom fraction and the overhead fraction, the bottom fraction contains said acetic acid, and the overhead fraction contains at least said methyl acetate and water.

25 13. A process according to claim 12, wherein the catalytic system comprises a catalyst containing a rhodium catalyst, an alkali metal iodide and methyl iodide;

the crude mixture is separated by the higher bp component-separation column into the bottom fraction and the overhead fraction, the bottom fraction contains at least propionic acid, and the overhead fraction contains  
5 acetic acid, methyl acetate, methyl iodide and water; and

the overhead fraction from the higher bp component-separation column is distilled by the carboxylic acid-separating column in the presence of said methyl acetate and methyl iodide, and is separated into the bottom  
10 fraction and the overhead fraction, the bottom fraction contains said acetic acid, and the overhead fraction contains said methyl acetate, methyl iodide and water.

14. A system for producing a carboxylic acid which comprises

15 a reaction system for allowing an alcohol having "n" carbon atom(s) or a derivative thereof to react with carbon monoxide continuously in the presence of a catalytic system,

a catalyst-separating column for separating a  
20 higher bp catalyst component from a reaction mixture generated in the reaction system,

a higher bp component-separation column for separating a crude mixture obtained by a separation in the catalyst-separating column and containing at least a  
25 carboxylic acid having "n+2" carbon atoms, a carboxylic acid having "n+1" carbon atoms, an ester of the carboxylic acid having "n+1" carbon atoms with the alcohol, and water,

into a bottom fraction and an overhead fraction, wherein the bottom fraction contains at least the carboxylic acid having "n+2" carbon atoms, and the overhead fraction contains at least the carboxylic acid having "n+1" carbon atoms, the ester of the carboxylic acid having "n+1" carbon atoms with the alcohol, and water, and

a carboxylic acid-separating column for separating the overhead fraction separated by the higher bp component-separation column into a bottom fraction and an overhead fraction, wherein the bottom fraction contains the carboxylic acid having "n+1" carbon atoms, and the overhead fraction contains at least the ester and water.